

Optimizing grafted watermelons spacing for yield and preventing *Fusarium* Wilt

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Introduction & preliminary research

Fusarium wilt in Watermelons

- Watermelons are an important cash crop for the state of Maryland. The majority in the state are grown on the Eastern Shore.
- Fusarium* wilt in Watermelons is caused by the soil borne fungal pathogen *Fusarium oxysporum* f. sp. Niveum and several new races have been identified in Maryland.
- There are few options for fungicide products to treat fields with this disease. Therefore, once a field has become infected with an outbreak of *Fusarium*, future watermelon production is not economically feasible.



Fig. 1) Depicts *Fusarium* wilt affecting a watermelon vine. The disease blocks the vascular tissue which lead to total plant collapse.

Grafted melons previous research

- UME conducted trials in 2021 analyzing the yields and fruit quality of grafted watermelons on farms with a history of *Fusarium*.
- In these trials two different rootstocks were tested and results indicated that Carolina Stongback, a citron interspecific hybrid, performed well under *Fusarium* pressure as well as root knot nematode pressure.
- Grafted plants cost more than traditional seedless watermelons ~\$1.85 per seedling.
- However, it was noted in the 2021 trails that the grafted seedless plants were more vigorous than ungrafted seedless plants.
- In 2022, 2023 the goals of this study were to understand plant spacing's effect on yield of grafted watermelons where the scion was a seedless melon variety.



Fig. 2) Grafted watermelon seedlings A) Shows the graft union unclipped and fully healed. B) Tray of grafted plants obtained from Tri-Hishtil. The scion was Facination and the rootstock was Carolina Stongback.

Hypotheses

H_0 = Grafted seedless watermelons will have the same yield at three different spacing density.

H_1 = Grafted seedless watermelons will **not** the same yield at three different spacing density.

Methods and field work

rep 1	rep 2	rep 3	rep 4
3	7	5	7
3	7	5	7
3	7	5	7
3	7	5	7
3	7	5	7
3	7	5	7

Fig. 3) Field layout for the Wicomico Farm in 2023. The field plots were 6 rows across with each row running 741' and each treatment plot = to 61'.

Experimental Design

- Seedless fascinations scions grafted to Carolina Stongback melons were grown on a private farm in St. Mary's County and on the University Research and Extension Farm in Wicomico in 2022, and a private farm in 2023.
- In 2022 and 2023 both field sites (Wicomico and St. Mary's) were setup as replicated controlled block design (RCBD).
- Pollinator plants were spaced every 3 seedless plants.

Field design 2022

- At both sites, in row spacing for watermelons was either 4', 6' or 8'.
- In Wicomico between row spacing was 7 ft. Plants per acre = 1556 at 4', 1037 at 6' and 778 at 8'.
- In St. Mary's between row spacing was 5 ft. Plants per acre = 2178 at 4', 1452 at 6' and 1089 at 8'.

Field design 2023

- In row spacing for watermelons in St. Mary's was either 4', 6' or 8' and in Wicomico it was 3', 5' or 7'.
- In 2023 in Wicomico between row spacing was 6 ft. Plants per acre = 2074 at 3', 1245 at 5' and 889 at 7'.
- In St. Mary's between row spacing was 5 ft. Plants per acre = 2178 at 4', 1452 at 6' and 1089 at 8'.

Yield measurements

- 2 harvest were performed both years at both sites.
- Melons were harvested from a middle section of each treatment. For example, in 2023 in Wicomico each treatment plot was 61 ft long, but only the middle 20 ft was harvested from (Fig. 4A).
- Harvested melons were counted and weighted immediately, and culls were counted (Fig. 4B,C).



Fig. 4) counting and weighing melons in the field. A) Field sampling area B) At the St. Mary's County site C) At the Wicomico County Site.

Results

2022 yield

- St. Mary's county field out yielded the Wicomico field (Fig 5B).
- The 6' spacing yielded the highest at both sites though not statistically significantly higher at St. Mary's (Fig 5B).
- In both St. Mary's and Wicomico the 6' spacing treatment had the highest \$ per acre field (Fig 5A).

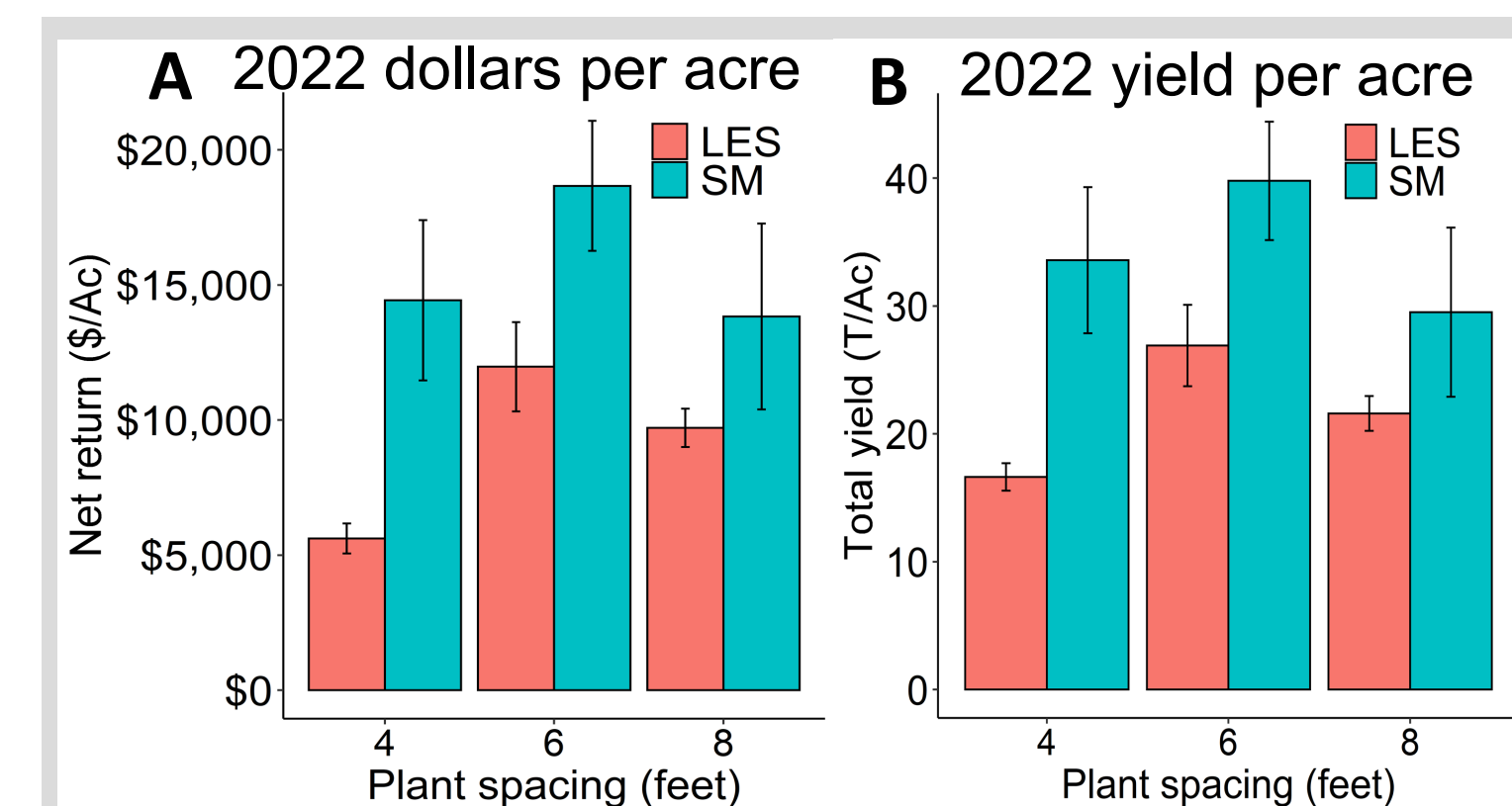


Fig. 5) A) Shows the estimated \$ return per acre for each spacing treatment at both sites with the Wicomico Field in pink and the St. Mary's field in blue. B) Shows the yield per acre for each spacing treatment at both sites.

2023 yield

- In St. Mary's the close (4') spaced treatment produced statistical higher yields than the far (8') spacing (Fig 6A).
- No statistical differences in yield were observed between spacing treatments in Wicomico (Fig 6A).
- At both sites, the far spaced plants yield larger melons equating to more lb plant than the close spaced plants (Fig 6B).

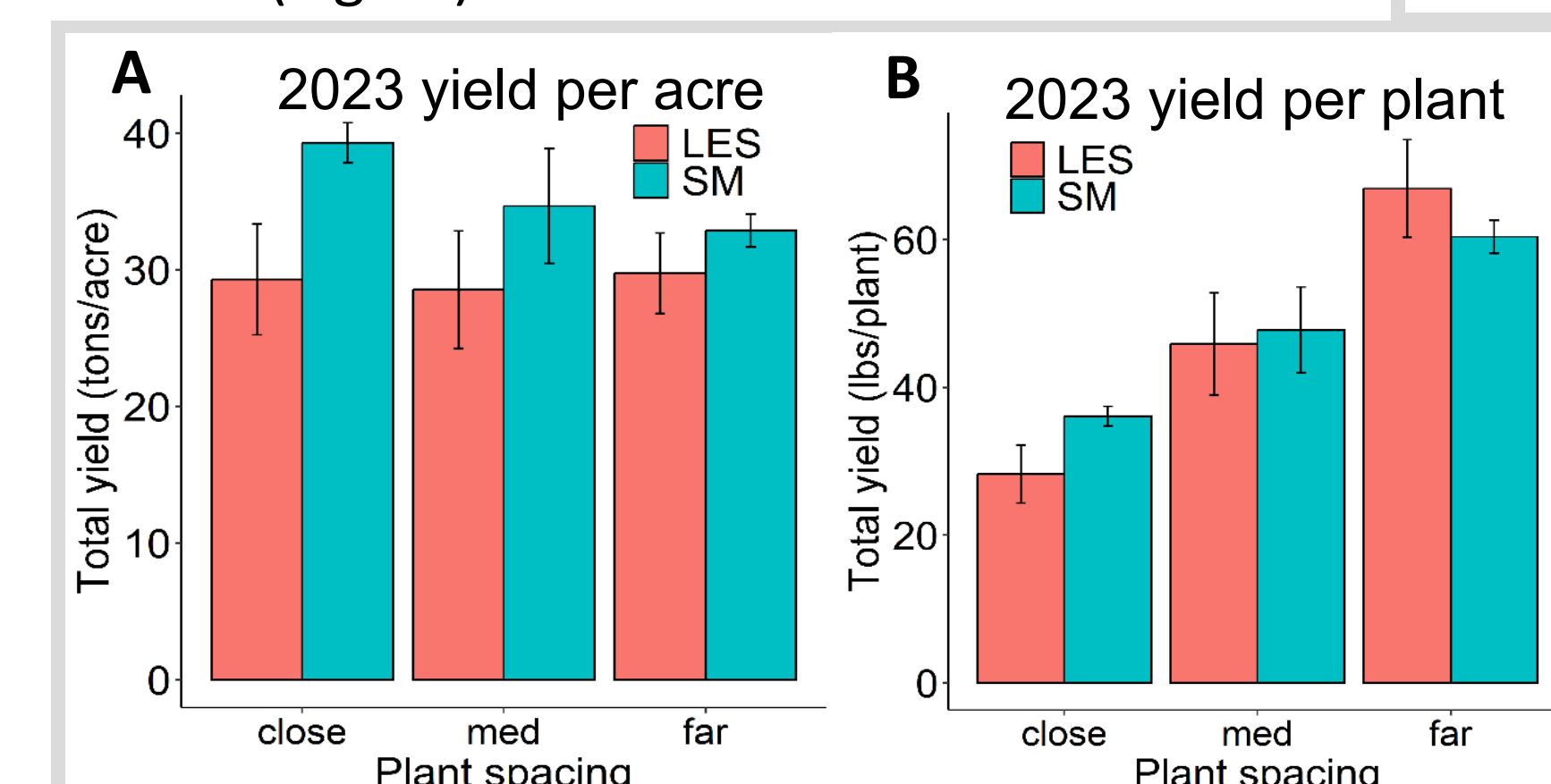


Fig. 6) A) Shows the yield per acre for each spacing treatment at both sites with the Wicomico Field in pink and the St. Mary's field in blue. B) Shows the per plant yield per acre for each spacing treatment at both sites with the Wicomico Field in pink and the St. Mary's field in blue.

Problems, and challenges

- In 2023 in Wicomico both *Phytophthora* (*Phytophthora capsica*) rot and *Fusarium* crown rot (*Fusarium solani*) broke out primarily in the medium spaced plots and resulted in more culls.
- Grafted rootstock provide no resistance to *Phytophthora* or *Fusarium* crown rot (Fig. 8A,B).



Fig. 8) A) *Phytophthora* infection of fruit. B) *Fusarium* crown rot infection in the field. C) Standing water in between watermelon rows caused by a heavy rain event that allowed fungal pathogens to move through the field.

Future questions and directions

- Are grafted melons worth the investment in absence of *Fusarium* Wilt or Root-Knot nematodes?
- What are ideal fertility recommendations? Do they require less nitrogen?
- What are the best pollinizer cultivars?
- Can spacing between rows be increased to save on plastic and drip tape costs?

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Conclusions

Our results differed between years and location sites. In 2022 The medium density spacing of 6' yielded the highest both in Wicomico County and Saint Mary's county. However, in 2023 the closer spaced treatment in St. Mary's yielded significantly more than the far spaced treatment, but there were no yield differences in Wicomico County between treatments spacing groups. Therefore, it's still unclear what planting spacing yields the highest tonnage per acre. However, one thing that was noted was that the farther spaced treatments yielded more pounds of melon per plant because the melons were statistically larger on average both years. Additionally, we found that the farther spaced treatments were ready to harvest earlier than the closer spaced melons with higher population density. It's still unclear if, in the absence of *Fusarium*, it makes economic sense to plant grafted melons because of the additional cost per plant.